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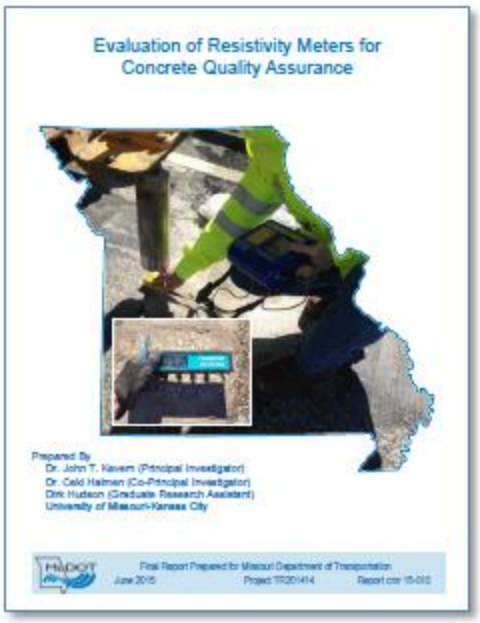
Research Summary

Evaluation of Resistivity Meters for Concrete Quality Assurance



This research evaluated a series of MoDOT concrete mixtures to verify existing relationships between surface resistivity (SR), rapid chloride permeability (RCP), chloride ion diffusion, and the AASHTO penetrability classes. The research also performed a precision and bias evaluation to provide acceptable limits should SR be implemented for quality assurance and to refine language in the AASHTO test standard.

In the precision and bias determination concrete was produced from three field sites and tested at both UMKC and MoDOT labs. Field mixtures included a paving mixture, a bridge deck mixture, and a structural mixture. Eleven other mix designs were produced in the lab and evaluated for RCP correlation and included paving, bridge deck, structural, and repair mixtures per Missouri Department of Transportation requirements. Additional testing included surface resistivity testing on sealed samples and an existing bridge deck.

Results showed excellent correlation between SR and RCP which matched existing relationships provided by AASHTO and other state DOTs. The structural mixture containing 50% Class F fly ash had the best performance with “very low” chloride ion penetrability at 90 days. A ternary paving mixture with 20% Class C fly ash and 30% slag replacement for cement also demonstrated low permeability as well as high compressive strength with an average value of over 9,000 psi at 90 days. The two repair mixtures showed moderate to low penetrability readings and high early strength consistent with their desired purpose.

Tests were also performed on a series of slab samples to evaluate SR as a tool for evaluating sealer application. The presence of silane and lithium silicate were able to be detected by the SR test.

As value added to the laboratory research, field testing was attempted on a bridge deck with the goal of providing non-destructive insight to the steel condition in the field. Due to the condition of the bridge conclusions could not be drawn other than making recommendations for future bridge deck evaluations.

The extensive amount of surface resistivity testing (>4500 tests) on 14 concrete mixtures at ages from 3 hours to 90 days using multiple labs, equipment, operators, and curing conditions has verified RCP relationships and allowed refinement of a testing procedure for a

Surface resistivity (SR) testing is faster and lower in cost to perform than rapid chloride permeability (RCP) testing.

MoDOT standard in the Engineering Policy Guide. Surface resistivity presents an opportunity to improve MoDOT concrete mixtures and specifications to increase durability without adding significant additional testing costs.

Surface Resistivity (SR) Test Procedure in Lab

Project Information

PROJECT NAME: Evaluation of Resistivity Meters for Concrete Quality Assurance

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PRINCIPAL INVESTIGATORS: Dr. John T. Kevern and Dr. Ceki Halmen

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